DOCUMENT RESUME

ED 350 439 CE 062 121

TITLE	Electrical Distribution Program Guide.
INSTITUTION	Georgia Univ., Athens. Dept. of Vocational Education.
SPONS AGENCY	Georgia State Dept. of Technical and Adult Education, Atlanta.
PUB DATE	90
CONTRACT	GA-89-110013
NOTE	116p.; For the program standards, see CE 062 122.
PUB TYPE	Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF01/PC05 Plus Postage.
DESCRIPTORS	*Behavioral Objectives; Competency Based Education; *Course Content; Course Descriptions; *Electrical Systems; *Electricity; *Electronic Technicians; Employment Potential; Entry Workers; Job Skills; Postsecondary Education; Program Guides; Safety; State Curriculum Guides; Technical Education; Technical Institutes; Two Year Colleges
IDENTIFIERS	Georgia

ABSTRACT

This program guide contains the standard electrical distribution curriculum for technical institutes in Georgia. The curriculum encompasses the minimum competencies required for entry-level workers in the electrical distribution field, and in job skills such as construction, maintenance, and repair of overhead and underground electrical distribution systems; live-line work; and cardiopulmonary resuscitation and other safety-related skills. The general information section contains the following: purpose and objectives; program description, including admissions, typical job titles, and accreditation and certification; and curriculum model, including standard curriculum sequence and lists of courses. The next three sections contain the courses: general core courses (English, mathematics, and interpersonal relations and professional development); fundamental technical courses (introduction to electrical distribution; safety for electrical distribution; fundamentals of electrical distribution; electrical system maps, schematics, and symbols; wiring for electrical distribution; electricity principles); and specific technical courses (power line construction, maintenance, and repair; transformers, underground residential and commercial distribution; advanced electrical distribution). Each course consists of the following: a course overview (description, competency areas, prerequisites, credit hours, contact hours); course outline with student objectives and class and lab hours; and resource list. An appendix to the guide lists equipment needed for the program. (KC)

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ELECTRICAL DISTRIBUTION
PROGRAM GUIDE

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ELECTRICAL DISTRIBUTION PROGRAM GUIDE

Developed and Produced
Under Contractual Agreement with

Office of Planning and Development
Department of Technical and Adult Education
Suite 660 South Tower
One CNN Center
Atlanta, Georgia 30303-2705
1990

ELECTRICAL DISTRIBUTION PROGRAM GUIDE

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ACKNOWLEDGEMENTS

The project staff expresses its sincere appreciation to the Georgia Department of Technical and Adult Education, the electrical distribution industry, and the state's technical institutes for their contribution to the development of this program guide. Kenneth Breeden and Robert Mabry of the Department of Technical and Adult Education provided initiative and direction for the project. Patt Stonehouse, the Director of Instructional Services for the Department of Technical and Adult Education provided invaluable assistance in the planning and monitoring of the project.

Without the close cooperation of members of the electrical distribution industry in Georgia, this program guide would not have been possible. The Electrical Distribution State Technical Committee provided overall direction, identified areas of concern, provided occupational outlook and equipment recommendations, participated in task analysis review, and reviewed the curriculum in this guide. The Occupational Working Committee composed of personnel from the Georgia Electrification Council and the technical institutes provided direct technical support and expertise in the development of this program guide. The members of these committees made the success of this endeavor possible. We would like to recognize those who participated on the Electrical Distribution State Technical and Occupational Working Committees below.

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We would like to thank all the other business, industry, and educational leaders who contributed to the development of this program guide. We would also like to thank Claire Thompson, Lois Brown, and Kevin Filan for communications, editorial assistance, and electronic publishing, respectively.

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HOW TO USE THIS MANUAL

Summary

This manual is divided into:

Tabs - major divisions, physically separated by numbered tab dividers

Sections - divisions within a tab

Subjects - divisions within a section

Numbering System

Each document (Subject) has a unique 6-digit number. This number is divided into 3 sets of 2 digits which are separated by dashes.

Example:	04	-	02	-	03
	TAB		SECTION		SUBJECT

Locating a Document

Document numbers appear on the upper right hand corner of each page (see top of this page). To locate a subject:

1. Refer to the Table of Contents.
2. Note the document number for the subject.

   Example: 04-02-03

3. Turn to the tab divider marked 04 and within this tab find Section 02 and Subject 03.

Table of Contents

The table of contents (00-00-01) is intended to give a cover-to-cover overview of the manual contents and organization. It lists contents of a Tab to the Section and Subject level.

Amendments

Registered manual holders are instructed to keep their manuals up-to-date.

Manuals Document Transmittal	All new or revised documents are sent to the registered holder of the manual and are recorded on a Manuals Document Transmittal Form. Transmittals are numbered consecutively, and instructions for use are printed on the form.
Amendment Record	The registered holder of the manual records the receipt of all manual document transmittals on the Amendment Record. This record and instructions are found on the reverse side of the manual title page.

GENERAL INFORMATION

Introduction

Overview

Electrical Distribution is a program of study which is consistent with the philosophy and purpose of the institution. The program provides academic foundations in communications, mathematics, and human relations, as well as occupational fundamentals. Program graduates are well trained in the underlying fundamentals of electrical distribution and are well prepared for employment and subsequent upward mobility.

The Electrical Distribution program is a specialized training program that provides the student with the knowledge and skills to become a competent apprentice powerline worker. Skills application plays a vital role in the comprehensive Electrical Distribution program. Important attributes of successful program graduates are critical thinking, problem solving, and the ability to apply technology to the work requirement. This field has experienced rapid expansion and the trend is expected to continue for the foreseeable future.

The program structure acknowledges individual differences and provides opportunities for students to seek fulfillment of their respective educational goals. The program does not discriminate on the basis of race, color, national origin, religion, sex, handicapping condition, academic disadvantage, or economic disadvantage.

To assist each student to attain his or her respective potential within the program, both the instructor and the student incur an obligation in the learning process. The instructor is a manager of instructional resources and organizes instruction in a manner which promotes learning. The student assumes responsibility for learning by actively participating in the learning process.

This is a dynamic field which requires extraordinary attention to current curriculum and up-to-date instructional equipment, materials, and processes. The Electrical Distribution program must promote the concept of change as the profession evolves. The need for nurturing the spirit of involvement and lifelong learning is paramount in the electrical distribution industry.

GENERAL INFORMATION

Introduction

Standard Curriculum

The Electrical Distribution program guide presents the standard electrical distribution curriculum for technical institutes in Georgia. This curriculum addresses the minimum competencies for the Electrical Distribution program. The competency areas included in a local Electrical Distribution program may exceed what is contained in this program guide, but it must encompass the minimum competencies contained herein.

As changes occur in the Electrical Distribution program, this guide will be revised to reflect those changes. Proposed changes are first evaluated and approved by the local program advisory committee and then forwarded to the State Technical Committee for approval and inclusion in the state standard program guide.

This program guide is designed to relate primarily to the development of those skills needed by individuals in the field such as construction, maintenance, and repair of overhead and underground electrical distribution systems; live-line work; and cardiopulmonary resuscitation and other safety-related skills.

GENERAL INFORMATION

Introduction

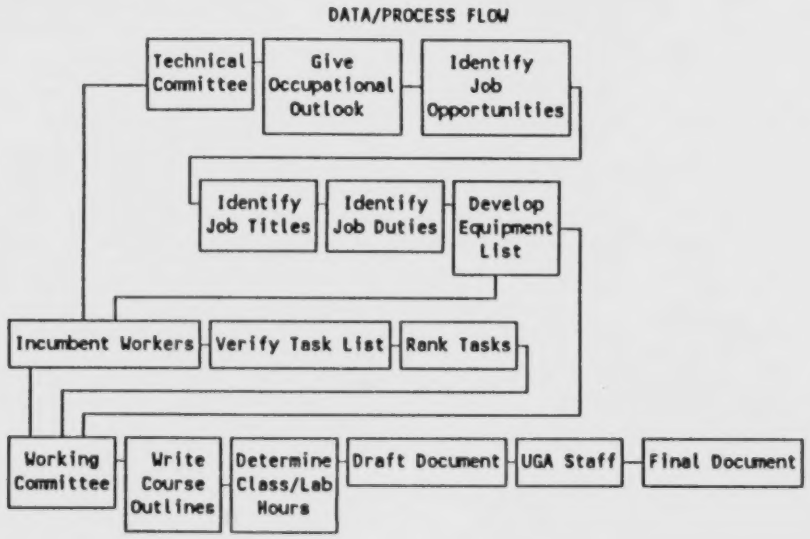
Developmental Process

The development of the Electrical Distribution program guide was based on the premise that the people in the industry can best determine program needs. With this in mind, representatives from businesses which would employ program graduates were asked to serve on a State Technical Committee to help identify the technical content and to provide overall guidance to ensure that the resulting program would produce graduates qualified for entry-level positions in the industry.

The State Technical Committee verified an occupational task list that had been compiled through extensive research. These representatives included workers who had actually performed the duties and tasks being verified.

Technical institutes which would implement the curriculum were also included in the developmental effort. Representatives from the technical institutes provided the expertise in teaching methodology unique to each discipline and developed the courses contained in this program guide.

The University of Georgia coordinated and directed the development of the curriculum and produced the final program guide. The role of each group in the developmental process is shown in the following diagram.



GENERAL INFORMATION

Introduction

Purpose and Objectives

Purpose

The purpose of the Electrical Distribution program is to provide educational opportunities to individuals that will enable them to obtain the knowledge, skills, and attitudes necessary to succeed in the electrical distribution field.

The Electrical Distribution program provides educational opportunities regardless of race, color, national origin, religion, sex, age, handicapping condition, academic disadvantage, or economic disadvantage.

The Electrical Distribution program is intended to produce graduates who are prepared for employment as apprentice powerline workers. Program graduates are to be competent in the general areas of communications, math, and professional relations.

Graduates are to be competent in techniques for the construction, maintenance, and repair of overhead and underground distribution systems; equipment operation; and safety-related skills.

Objectives

1. Provide current curriculum, instructional materials, and equipment (in accordance with available funding) which teach knowledge, skills, and attitudes appropriate to industry needs.

2. Provide educational facilities which foster learning and provide safe, healthy environments available and accessible to all students who can benefit from the program.

3. Provide academic instruction which supports effective learning within the program and which enhances professional performance on the job.

4. Provide employability skills which foster work attitudes and work habits that will enable graduates of the program to perform as good employees.

5. Nurture the desire for learning so that graduates will pursue their own continuing education as a lifelong endeavor.

6. Provide an educational atmosphere which promotes a positive self image and a sense of personal well being.

7. Provide education that fosters development of good safety habits.

8. Provide admission, educational, and placement services without regard to race, color, national origin, religion, sex, age, or handicapping condition.

9. Provide information to the public regarding the program that will facilitate recruitment and enrollment of students.

10. Promote good public relations via contacts and regular communications with business, industry, and the public sector.

11. Promote faculty and student rapport and communications to enhance student success in the program.

GENERAL INFORMATION

Program Description

Program Defined

The Electrical Distribution program prepares students for employment in a variety of positions in today's electrical distribution industry. The Electrical Distribution program provides learning opportunities which introduce, develop, and reinforce academic and occupational knowledge, skills, and attitudes required for job acquisition, retention, and advancement. Graduates of the program receive an Electrical Distribution diploma and are qualified as apprentice powerline workers.

GENERAL INFORMATION

Program Description

Admissions

Admissions Requirements

Admission of new students to the Electrical Distribution program is contingent upon their meeting all of the following requirements:

a) attainment of 17 or more years of age;
b) achievement of the 8th grade level in math, reading, and English as shown on a statistically validated test; and
c) completion of application and related procedures.

Admission of transfer students is contingent upon their meeting the following:

a) regular admission and good standing at a regionally accredited diploma or degree granting institution; and
b) proper completion of application and related procedures.

Provisional Admission

A new student who does not meet the regular admission requirements of the program may be admitted on a provisional basis. The requirements for provisional admission are:

a) attainment of 17 or more years of age;
b) achievement of the 7th grade level in math, reading, and English as shown on a statistically validated test or recommendation by program faculty and designated admissions personnel on the basis of interview and assessment of student potential; and
c) completion of application and related procedures.

GENERAL INFORMATION

Program Description

Typical Job Titles

The Electrical Distribution program is assigned a (PGM) CIP code of (PGM) 46.0303 and is consistent with all other programs throughout the state which have the same (PGM) CIP code. Related D.O.T. job titles follow:

821.361-026	Line repairer (light, heat, and power)
821.684-014	Tower erector helper (construction; light, heat, and power)

Document Number:
01-02-04

GENERAL INFORMATION

Program Description

Accreditation and Certification

This program must conform to the institutional accreditation requirements of the Southern Association of Colleges and Schools by meeting Commission on Colleges (COC) or Commission on Occupational Education Institutions (COEI) accreditation requirements and must not conflict with the accreditation criteria established by COC and COEI.

GENERAL INFORMATION

Curriculum Model

Standard Curriculum

The standard curriculum for the Electrical Distribution program is set up on the quarter system. Technical institutes may implement the Electrical Distribution program using one of the sequences listed below or using a locally developed sequence designed to reflect course prerequisites and/or corequisites.

Course		Class Hours	Lab Hours	Weekly Contact Hours	Credits
SUGGESTED SEQUENCE I					
FIRST QUARTER					
ELD 101	Introduction to Electrical Distribution	5	5	10	6
ELT 102	Electricity Principles	8	6	14	9
MAT 101	General Mathematics	5	0	5	5
		18	11	29	20
SECOND QUARTER					
ELD 102	Safety for Electrical Distribution	5	5	10	6
ELD 103	Fundamentals of Electrical Distribution	4	9	13	6
ENG 100	English	5	0	5	5
		14	14	28	17

Course		Class Hours	Lab Hours	Weekly Contact Hours	Credits
THIRD QUARTER					
ELD 104	Electrical System Maps, Shematics, and Symbols	2	1	3	2
ELD 105	Wiring for Electrical Distribution	3	2	5	3
ELD 106	Powerline Construction, Maintenance, and Repair	5	9	14	7
PSY 100	Interpersonal Relations and Professional Development	3	0	3	3
XXX xxx	Occupational or Occupationally Related Electives	-	-	-	5
		13	12	25	20
FOURTH QUARTER					
ELD 107	Transformers	4	6	10	6
ELD 108	Underground Residential and Commercial Distribution	4	5	9	5
ELD 109	Advanced Electrical Distribution	3	7	10	5
		11	18	29	16

Course		Class Hours	Lab Hours	Weekly Contact Hours	Credits
SUGGESTED SEQUENCE II					
FIRST QUARTER					
ELD 101	Introduction to Electrical Distribution	5	5	10	6
ELT 102	Electricity Principles	8	6	14	9
MAT 101	General Mathematics	5	0	5	5
		18	11	29	20
SECOND QUARTER					
ELD 102	Safety for Electrical Distribution	5	5	10	6
ELD 103	Fundamentals of Electrical Distribution	4	9	13	6
ELD 104	Electrical System Maps, Schematics, and Symbols	2	1	3	2
PSY 100	Interpersonal Relations and Professional Development	3	0	3	3
		14	15	29	17
THIRD QUARTER					
ELD 105	Wiring for Electrical Distribution	3	2	5	3
ELD 106	Powerline Construction, Maintenance, and Repair	5	9	14	7
ENG 100	English	5	0	5	5
XXX xxx	Occupational or Occupationally Related Electives	-	-	-	5
		13	11	24	20

Course		Class Hours	Lab Hours	Weekly Contact Hours	Credits
FOURTH QUARTER					
ELD 107	Transformers	4	6	10	6
ELD 108	Underground Residential and Commercial Distribution	4	5	9	5
ELD 109	Advanced Electrical Distribution	3	7	10	5
		11	18	29	16

GENERAL INFORMATION

Curriculum Model

General Core Courses

The general core courses provide students with a foundation in the basic skills which enable them to express themselves more clearly, both orally and in writing, and to perform the mathematical functions required in this occupation. The general core courses for the Electrical Distribution program are listed below.

ENG 100	English	5 Credits
MAT 101	General Mathematics	5 Credits
PSY 100	Interpersonal Relations and Professional Development	3 Credits

GENERAL INFORMATION

Curriculum Model

Fundamental Occupational Courses

The fundamental occupational courses provide students with a foundation in the area of electrical distribution which is needed to progress to the more highly specialized courses in electrical distribution. The fundamental occupational courses are listed below.

ELD 101	Introduction to Electrical Distribution	6 Credits
ELD 102	Safety for Electrical Distribution	6 Credits
ELD 103	Fundamentals of Electrical Distribution	6 Credits
ELD 104	Electrical System Maps, Schematics, and Symbols	2 Credits
ELD 105	Wiring for Electrical Distribution	3 Credits
ELT 102	Electricity Principles	9 Credits

GENERAL INFORMATION

Curriculum Model

Specific Occupational Courses

The specific occupational courses build upon the fundamental occupational courses to provide students with the basic knowledge and skill required to work as apprentice powerline workers. The specific occupational courses offered in the Electrical Distribution program are listed below.

ELD 106	Powerline Construction, Maintenance, and Repair	7 Credits
ELD 107	Transformers	6 Credits
ELD 108	Underground Residential and Commercial Distribution	5 Credits
ELD 109	Advanced Electrical Distribution	5 Credits
	Occupational or Occupationally Related Electives	5 Credits

GENERAL INFORMATION

Curriculum Model

Electives

Elective courses are provided to allow for the different levels of prior knowledge and skills brought to the classroom by students with diverse backgrounds, educational attainment, and specialized interests.

Decisions regarding the selection and appropriateness of any elective are made by the student after consultation with the instructor. Courses from other departments may be taken as electives when considered appropriate for a student's academic circumstances and career goals.

GENERAL CORE

ENG 100 - English

Course Overview

Course Description

Emphasizes the development and improvement of written and oral communications abilities. Topics include: basic grammar; language usage; vocabulary; idea development; spelling; outlining; sentence elements; sentence development; paragraph development; revision; listening skills; reading skills; and locating, using, and organizing information. Homework assignments reinforce classroom learning.

Competency Areas

Basic Oral Communications
Listening Skills
Basic Grammar and Sentence Skills
Paragraph Development
Reading Skills

Prerequisite

Program admission level English and reading competency

Credit Hours

5

Contact Hours Per Week

Class - 5

Lab - 0

GENERAL CORE

ENG 100 - English

Course Outline

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
BASIC ORAL COMMUNICATIONS		**15**	**0**
Telephone etiquette	Recognize effective telephone communication.		
Small group interaction	Participate in group interaction.		
Language registers	Recognize different levels of language.		
Oral presentations	Give oral presentations.		
	Interview and introduce a person.		
	Demonstrate a product or procedure.		
	Convey thoughts in a way that accomplishes desired results.		
	Role play a job-related situation.		
LISTENING SKILLS		**5**	**0**
Listening techniques	Summarize and paraphrase.		
Nonverbal communication	Take accurate notes that summarize material presented.		
	Interpret nonverbal clues.		
Directions	Follow directions.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
Reference usage	Reinforce reading skills through reference usage. Complete a library worksheet on locating various references. Demonstrate the ability to use indexes to find information in professional journals.		

Recommended Outline	After completing this section, the student will:	Hours Class	Lab
Reference usage	Reinforce reading skills through reference usage. Complete a library worksheet on locating various references. Demonstrate the ability to use indexes to find information in professional journals.		

GENERAL CORE

ENG 100 - English

Resources

Lewis, S. D., Smith, H., Baker, F., Ellegood, G., Kopay, C., & Tanzer, W. (1988). *Writing skills for technical students* (2nd ed.). Englewood Cliffs, NJ: Prentice Hall.

VanAlstyne, J. S. (1986). *Professional and technical writing strategies*. Englewood Cliffs, NJ: Prentice Hall.

GENERAL CORE

MAT 101 - General Mathematics

Course Overview

Course Description

Emphasizes mathematical skills that can be applied to the solution of occupational/technical problems. Topics include: properties of numbers, fractions, decimals, percents, ratio/proportion, measurement and conversions, exponents, and geometric and technical formulas. Class includes lectures, applications, and homework to reinforce learning.

Competency Areas

Properties of Numbers
Fractions
Decimals
Percents
Ratio/Proportion
Measurement/Conversions
Exponents and Radicals
Geometric and Technical Formulas

Prerequisite

Program admission level math competency

Credit Hours

5

Contact Hours Per Week

Class - 5

Lab - 0

GENERAL CORE

MAT 101 - General Mathematics

Course Outline

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
PROPERTIES OF NUMBERS		**5**	**0**
Whole numbers	Identify prime and composite numbers. Solve whole number problems using mathematical operations of addition, subtraction, multiplication, division, and powers.		
FRACTIONS		**10**	**0**
Definition of fractions	Define a fraction. Identify proper, improper, and mixed fractions.		
Equivalent fractions	Solve problems relating to equivalent fractions.		
Mathematical operations using fractions	Solve problems requiring multiplication, division, addition, and subtraction of fractions.		
DECIMALS		**5**	**0**
Definition of decimals and place value	Perform mathematical operations using decimals.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
Basic operations of mathematics with decimals	Solve problems using decimals, scientific notation, and powers of ten.		
Conversion of fractions to decimals and decimals to fractions			
Powers of ten			
PERCENTS		**5**	**0**
Definition of percents	Work problems using percents dealing with mixtures and interests.		
Conversion between fractions and decimals			
Base-rate-part problems			
Mixture and interest			
RATIO/PROPORTION		**10**	**0**
Definition of rate, ratio, and proportions	Construct and solve problems involving ratios and proportions.		
Variation: direct and inverse	Identify, setup, and solve proportionality problems.		
Measurement and conversion	Solve problems and applications in measurement and conversions.		
Definition of basic units of measurement	Use dimensioning.		
	Convert between measurement systems.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
EXPONENTS AND RADICALS		**5**	**0**
Laws of exponents	Apply laws of exponents to simplify complex exponents expressions.		
Radicals	Find roots of numbers.		
GEOMETRIC AND TECHNICAL FORMULAS		**10**	**0**
Types of formulas	Identify basic two and three dimensional figures.		
	Find the areas of rectangular and circular figures.		
	Solve for volumes of cubes, rectangular solids, and right circular cylinders.		
	Identify, measure, and solve problems using angles.		
	Solve and manipulate basic algebraic and trigonometric formulas.		

GENERAL CORE

MAT 101 - General Mathematics

Resources

Harter, J. H., & Beitzel, W. D. (1988). *Mathematics applied to electronics* (3rd ed.). Englewood Cliffs, NJ: Prentice Hall.

Heywood, A. (1982). *Arithmetic: A programmed worktext.* Monterey, CA: Brooks/Cole.

Johnston, C. L., Willis, A. T., & Hughes, G. M. (1984). *Essential arithmetic* (4th ed.). Belmont, CA: Wadsworth.

Keedy, M. L., & Bittinger, M. L. (1983). *Introductory algebra* (4th ed.). Perdue, IN: Addison-Wesley.

Keedy, M. L., & Bittinger, M. L. (1985). *Essential mathematics* (4th ed.). Perdue, IN: Addison-Wesley.

Lewis, H. (1986). *Technical mathematics.* Albany, NY: Delmar.

Palmer, C. L., & Rachek, L. A. (1986). *Practical mathematics* (7th ed.). Minneapolis: McGraw-Hill.

Proga, R. (1987). *Basic mathematics* (2nd ed.). Boston: Prindle, Weber & Schmidt.

Washington, A. J., & Triola, M. F. (1984). *Technical mathematics* (3rd ed.). Poughkeepsie, NY: Benjamin/Cummings.

GENERAL CORE

PSY 100 - Interpersonal Relations and Professional Development

Course Overview

Course Description

Provides a study of human relations and professional development in today's rapidly changing world that prepares students for living and working in a complex society. Topics include: personal skills required for understanding the self and others; projecting a professional image; job acquisition skills such as conducting a job search, interviewing techniques, job application, and resume preparation; desirable job performance skills; and desirable attitudes necessary for job retention and advancement.

Competency Areas

Human Relations Skills
Job Acquisition Skills
Job Retention Skills
Job Advancement Skills
Professional Image Skills

Prerequisite

Provisional admission

Credit Hours

3

Contact Hours Per Week

Class - 3

Lab - 0

Document Number:
02-03-02

GENERAL CORE

PSY 100 - Interpersonal Relations and Professional Development

Course Outline

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
HUMAN RELATIONS SKILLS		**6**	**0**
Goal setting	Develop and set personal goals.		
Stress management	Diagnose and respond to own stress level.		
Behavior problems	Identify strategies to handle difficult behaviors effectively.		
Personal introductions	Make proper introductions.		
Problem solving/ decision making	Identify strategies to solve problems/make decisions.		
JOB ACQUISITION SKILLS		**15**	**0**
Job search	Identify strategies to conduct a job search.		
Career goals	Develop and set career goals.		
Employment documents	Prepare letter of application.		
	Prepare resume/applications.		
	Prepare follow-up letters.		
Interviewing	Demonstrate interviewing techniques.		

Recommended Outline	After completing this section, the student will:	Hours Class	Lab
JOB RETENTION SKILLS		**3**	**0**
Office relationships	Identify techniques used to work effectively with coworkers.		
Time management	Develop time management strategies.		
JOB ADVANCEMENT SKILLS		**3**	**0**
Performance appraisal	Demonstrate ability to accept counseling positively.		
	Demonstrate ability to negotiate promotion/salary increase.		
Supervisory chain	Explain chain of responsibility.		
PROFESSIONAL IMAGE SKILLS		**3**	**0**
Image	Project professional image.		
Attitude	Project professional attitude.		

GENERAL CORE

PSY 100 - Interpersonal Relations and Professional Development

Resources

DuBrin, A. G. (1988). *Human relations - A job oriented approach* (4th ed.). Englewood Cliffs, NJ: Prentice Hall.

Milton, C. R. (1981). *Human behavior in organizations*. Englewood Cliffs, NJ: Prentice Hall.

Reynolds, C. *Dimensions in professional development* (3rd ed.). Cincinnati, OH: South-Western.

Rogers, C. R. (1981). *Human behavior in organizations*. Cincinnati, OH: South-Western.

Wilkes, M., & Crosswait, C. B. *Professional development--The dynamics of success* (3rd ed.). Atlanta: Harcourt Brace & Jovanovich.

Williams, C., Jr. (1982). *Human behavior in organizations*. Cincinnati, OH: South-Western.

Document Number:
03-01-01

FUNDAMENTAL OCCUPATIONAL

ELD 101 - Introduction to Electrical Distribution

Course Overview

Course Description

Provides an overview of employment characteristics, opportunities, and responsibilities; work-related attitudes; and potential health and safety hazards associated with the electrical distribution field. Laboratory experiences are included in tool identification and basic ropecraft. Topics include: job characteristics and responsibilities, skill requirements, potential health and safety hazards, employment opportunities, attitudes toward work, alcohol and drug abuse, tool identification, and basic rope handling.

Competency Areas

Job Characteristics and Responsibilities
Skill Requirements
Potential Health and Safety Hazards
Employment Opportunities
Attitudes Toward Work
Alcohol and Drug Abuse
Tool Identification
Basic Rope Handling

Prerequisite

Provisional admission

Credit Hours

6

Contact Hours Per Week

Class - 5

D.Lab - 1

P.Lab - 4

FUNDAMENTAL OCCUPATIONAL

ELD 101 - Introduction to Electrical Distribution

Course Outline

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
JOB CHARACTERISTICS AND RESPONSIBILITIES		**7**	**0**
Occupational overview	Describe the powerline worker.		
	Describe the work environment associated with the powerline worker.		
	Identify potential hazards associated with the powerline worker field.		
	Identify employment opportunities available to a powerline worker.		
	List salary and benefits associated with the powerline worker field.		
Role responsibilities	Describe personal attire and equipment used by a powerline worker.		
	Demonstrate a willingness to learn.		
	Exhibit dependability.		
	Demonstrate punctuality.		
	Demonstrate the ability to communicate with customers in an approved manner.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Demonstrate a professional appearance and attitude.		
	Explain the importance of job site cleanliness.		
SKILL REQUIREMENTS		**28**	**32**
Occupational skills	Describe the occupational skills of the powerline worker.		
Tool skills	Identify hand and power tools.		
	Identify line tools.		
	Identify volt-amp meters.		
	Describe the care of hand and line tools.		
	Identify wire tong saddles.		
	Describe the importance of utilizing equipment and tools appropriately.		
	Identify underground distribution cable and fault locating equipment.		
	Identify personal climbing tools.		
	Identify Baker boards.		
Electrical systems	Identify transformers (both current and potential transformers).		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Identify transmission lines and stations by voltages, structures, and purpose.		
	Identify distribution substations by voltages and purpose.		
	Identify components of a substation.		
	Identify three-phase distribution.		
	Identify two-phase distribution.		
	Identify single-phase distribution.		
	Identify secondary lines and structures.		
	Identify underground residential distribution (URD) components and structures.		
Safety skills	Demonstrate a willingness to comply with health and safety rules.		
	Name hazardous materials commonly used in the electrical distribution industry.		
	Explain the importance of using personal protective equipment (i.e., hard hat, eye protection, rubber shoes, and gloves).		
	Explain the importance of maintaining personal protective equipment.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Identify the reasons for using protective cover-up equipment (i.e., rubber blanket, rubber [flexible] line hose, and rubber [rigid] line guards).		
Public relations skills	Identify terms associated with customer contact.		
	Describe proper communication techniques involved with customer contact.		
	Explain the procedures for proper entry of private property with regard to private property damage.		
POTENTIAL HEALTH AND SAFETY HAZARDS		3	1
Personal health and safety	Identify potential hazards associated with the powerline worker field.		
	Explain the importance of job site cleanliness.		
	Maintain cleanliness on the job site.		
Occupational health and safety	Identify the need for obtaining certification in the use of cardiopulmonary resuscitation (CPR) techniques.		
	Identify the need for obtaining certification in multi-media first aid techniques.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
EMPLOYMENT OPPORTUNITIES		**1**	**0**
Careers	Identify employment opportunities available to a powerline worker.		
Salaries and benefits	List salary and benefits associated with the powerline worker field.		
ATTITUDES TOWARD WORK		**1**	**0**
Work ethics	Demonstrate a willingness to learn.		
	Exhibit dependability.		
	Demonstrate punctuality.		
	Demonstrate the ability to communicate with customers in an approved manner.		
	Exhibit pride and loyalty.		
ALCOHOL AND DRUG ABUSE		**3**	**0**
Forms of drug abuse	Describe common forms of drug abuse.		
Effects on job performance	Describe the effects of drug abuse on job performance.		
Personal effects of drug abuse	Describe the physical and psychological effects of drug abuse.		
TOOL IDENTIFICATION		**2**	**2**
Tools	Identify hand and power tools.		

Recommended Outline	After completing this section, the student will:	Hours Class	Lab
	Identify volt-amp meters.		
	Describe the care of hand and line tools.		
	Identify hot line tools.		
BASIC ROPE HANDLING		**5**	**15**
Knot tying	Tie a crown knot.		
	Tie a bowline knot.		
	Tie a clove hitch knot.		
	Tie a rolling bend knot.		
	Tie a square knot.		
	Tie a timber hitch knot.		
	Identify the effects of knots on the strength of rope.		
Splicing	Splice (end, eye, and running) rope.		
Selection	Select types of rope for specific purposes.		
Care	Coil rope.		
Rigging skills	Identify types of slings.		
	Select types of rope for rigging.		
	Identify block and tackle assemblies.		
	Rig block and tackle for heavy lifting.		

FUNDAMENTAL OCCUPATIONAL

ELD 101 - Introduction to Electrical Distribution

Resources

American Public Power Association. (1988). *Safety manual for an electric utility* (8th ed.). Washington, DC: Author.

Edison Electrical Institute. (1970). *Glossary of electrical utility terms*. Washington, DC: Author.

Kurtz, E. B., & Shoemaker, T. M. (1986). *The lineman's and cableman's handbook* (7th ed.). New York: McGraw-Hill.

Document Number:
03-02-01

FUNDAMENTAL OCCUPATIONAL

ELD 102 - Safety for Electrical Distribution

Course Overview

Course Description

Introduces potential hazards related to the use and distribution of electricity. Emphasis is placed on how electrical shock or electrocution occurs; methods of shock prevention such as clearance, cover-up, and grounding; treatment for victims of electrical shock; federal and state regulations relating to the field; first aid techniques; considerations relating to safe vehicle operation; and attitudes that support safe work practices. Topics include: potential hazards of electricity and shock prevention; care and safe use of tools, equipment, and personal protective equipment; first aid and cardiopulmonary resuscitation certification; the Right-To-Know Law and the Material Safety Data Sheet; worksite setup; the National Electrical Safety Code (N.E.S.C.); survey of pole-top, bucket truck, and manhole rescue techniques; and vehicle operation regulations, licensure requirements, and safety; and hand signals.

Competency Areas

Potential Hazards of Electricity and Electrical Shock Prevention
Care and Safe Use of Tools, Equipment, and Personal Protective Equipment
First Aid and Cardiopulmonary Resuscitation Certification
Right-to-Know Law and the Material Safety Data Sheet
Worksite Setup
National Electrical Safety Code (N.E.S.C.)
Survey of Pole-Top, Bucket Truck, and Manhole Rescue Techniques
Vehicle Operation Regulations, Licensure Requirements, and Safety
Hand Signals

Prerequisites/Corequisites

ELD 101, ELT 102

Credit Hours

6

Contact Hours Per Week

Class - 5

D.Lab - 1

P.Lab - 4

FUNDAMENTAL OCCUPATIONAL

ELD 102 - Safety for Electrical Distribution

Course Outline

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
POTENTIAL HAZARDS OF ELECTRICITY AND ELECTRICAL SHOCK PREVENTION		**12**	**13**
Electrical shock	Describe how electrical shock occurs.		
Shock prevention	Identify the three basic principles (i.e., clearance, cover-up, and grounding) used to prevent electrical shock.		
	Identify the role of personal protective equipment (i.e., hard hat, eye protection, rubber shoes, and gloves) in preventing electrical shock.		
	Identify the importance of maintaining personal protective equipment.		
Grounding techniques	Identify line grounding techniques (equalization of electrical potential, both single point and working between grounds).		
	Identify equipment grounding techniques.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Identify protective cover-up equipment (i.e., rubber blanket, rubber [flexible] line hose, rubber [rigid] line guards).		
	Identify the need for a dead line clearance.		
CARE AND SAFE USE OF TOOLS, EQUIPMENT, AND PERSONAL PROTECTIVE EQUIPMENT		**10**	**13**
Rubber gloves	Identify rubber glove classifications according to the American Society of Testing and Materials.		
	Identify methods of electrically testing rubber gloves.		
	Identify methods for field testing rubber gloves.		
Personal protective equipment	Identify personal protective equipment (i.e., hard hat, eye protection, rubber shoes, and gloves).		
	Identify procedures for maintaining personal protective equipment.		
	Identify equipment grounding techniques.		
	Identify procedures for inspecting tools and personal protective equipment.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
FIRST AID AND CARDIOPULMONARY RESUSCITATION CERTIFICATION		**8**	**7**
Cardiopulmonary resuscitation	Demonstrate the skills necessary to become certified in the use of cardiopulmonary resuscitation.		
First aid	Demonstrate the skills necessary to become certified in multi-media first aid techniques.		
RIGHT-TO-KNOW LAW AND THE MATERIAL SAFETY DATA SHEET		**3**	**0**
Hazardous materials	Identify hazardous materials used in the electrical distribution industry.		
Material Safety Data Sheet	Identify the provisions of the Hazardous Duty Standards Act (Right-to-Know legislation and the Material Safety Data Sheet).		
WORKSITE SETUP		**6**	**8**
Job site safety	Demonstrate the skills necessary to become certified in Department of Transportation (D.O.T.) approved flagging techniques. Identify methods for setting up and operating a roadside work site. Identify the importance of proper shoring during trenching and other excavation activities.		

Recommended Outline	After completing this section, the student will:	Hours Class	Lab
	Identify safe positioning and procedures for setup of vehicles and other equipment.		
NATIONAL ELECTRICAL SAFETY CODE (N.E.S.C.)		**2**	**0**
N.E.S.C. purposes	Explain the purpose of the National Electrical Safety Code.		
SURVEY OF POLE-TOP, BUCKET TRUCK, AND MANHOLE RESCUE TECHNIQUES		**4**	**2**
Rescue methods	Identify techniques for pole-top, manhole, and bucket truck rescue.		
VEHICLE OPERATION REGULATIONS, LICENSURE REQUIREMENTS, AND SAFETY		**5**	**5**
D.O.T. requirements	Identify D.O.T. requirements for operating vehicles over 10,000 lbs. gross weight.		
Vehicle safety	Meet defensive driving certification requirements.		
	Rig a pole trailer for road transportation (both day and night).		
	Perform trailer backing techniques.		
HAND SIGNALS		**0**	**2**
Hand signal identification	Identify hand signals used to direct powerline construction and repair operations.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Become proficient in the use of hand signals.		

FUNDAMENTAL OCCUPATIONAL

ELD 102 - Safety for Electrical Distribution

Resources

American Public Power Association. (1988). *Safety manual for an electric utility* (8th ed.). Washington, DC: Author.

American Red Cross. (1987). *Cardiopulmonary resuscitation CPR.* Ft. Wayne, IN: Author.

Bartsch, J. H. (1987). *School materials safety manual.* Schenectady, NY: Genium.

Center for Occupational Research & Development. (1981). *Electrical power transmission & distribution safety.* Waco, TX: Author.

The Institute of Electrical and Electronics Engineers, Inc. (1988). *National electrical safety code, 1988 edition.* New York: Author.

Kurtz, E. B., & Shoemaker, T. M. (1986). *The lineman's and cableman's handbook* (7th ed.). New York: McGraw-Hill.

National Institute for Occupational Safety and Health. (1981). *Work practices guide for manual lifting.* Cincinnati, OH: Author.

FUNDAMENTAL OCCUPATIONAL

ELD 103 - Fundamentals of Electrical Distribution

Course Overview

Course Description

Introduces electrical distribution practices and procedures. Topics include: identification and applications of materials and components, rope handling and rigging, manual pole handling, pole climbing and inspection, and safety.

Competency Areas

Materials and Components
Rope Handling and Rigging
Manual Pole Handling
Pole Climbing and Inspection
Safety

Prerequisites/Corequisites

ELD 101, ELD 102, ELT 102

Credit Hours

6

Contact Hours Per Week

Class - 4

D.Lab - 1

P.Lab - 8

Document Number:
03-03-02

FUNDAMENTAL OCCUPATIONAL

ELD 103 - Fundamentals of Electrical Distribution

Course Outline

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
MATERIALS AND COMPONENTS		**13**	**20**
Materials	Identify classes of poles.		
	Identify cross arms and braces.		
	Identify types of insulators.		
	Identify types and sizes of conductors.		
	Identify types of grounding devices.		
	Identify types of sleeves and connectors.		
	Identify types of overhead and underground conductors.		
	Identify types of ties, preforms, and armor rods.		
	Identify types of anchors.		
Components	Identify types of overhead and underground transformers.		
	Identify types of underground terminators.		
	Identify types of elbows.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Identify types of interrupters (load buster tool).		
	Identify types of fuses.		
	Identify types of switches.		
	Identify types of arrestors.		
	Identify types of capacitors.		
	Identify types of oil circuit reclosers.		
	Identify switching cabinets and cubicles.		
	Identify transformer pads.		
	Identify electronic three-phase breakers.		
	Identify components of various types of lighting systems (e.g., area, street, and security lighting).		
ROPE HANDLING AND RIGGING		**10**	**17**
Rigging	Identify block and tackle assemblies.		
	Use block and tackle.		
	Make up one and two sheave blocks.		
Rope handling	Calculate the safe working load of various ropes and cables.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Identify methods of inspecting ropes and cables.		
	Fabricate hand and tag lines.		
	Make up hand lines.		
MANUAL POLE HANDLING		**7**	**13**
Transportation	Load and unload poles on pole trailer.		
Installation	Set and align pole.		
POLE CLIMBING AND INSPECTION		**3**	**30**
Pole climbing	Identify personal climbing tools.		
	Adjust personal climbing tools for proper fit.		
	Climb poles using personal climbing tools.		
Inspection	Inspect poles for unsafe conditions before climbing.		
	Inspect personal climbing tools for safe condition.		
SAFETY		**7**	**10**
Personal positioning	Describe the concept of personal positioning as it relates to pole handling.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
Protective equipment	Inspect tools and personal protective equipment.		

FUNDAMENTAL OCCUPATIONAL

ELD 103 - Fundamentals of Electrical Distribution

Resources

American Public Power Association. (1988). *Safety manual for an electric utility* (8th ed.). Washington, DC: Author.

Center for Occupational Research & Development. (1981). *Electrical power transmission & distribution safety.* Waco, TX: Author.

Kurtz, E. B., & Shoemaker, T. M. (1986). *The lineman's and cableman's handbook* (7th ed.). New York: McGraw-Hill.

FUNDAMENTAL OCCUPATIONAL

ELD 104 - Electrical System Maps, Schematics, and Symbols

Course Overview

Course Description

Introduces electrical symbols and their meaning in electrical distribution system maps, electrical schematics, and diagrams. Topics include: system map reading, electrical symbols and schematic diagrams, and component identification.

Competency Areas

System Map Reading
Electrical Symbols and Schematic Diagrams
Component Identification

Prerequisites/Corequisites

ELD 101, ELT 102

Credit Hours

2

Contact Hours Per Week

Class - 2

P.Lab - 1

FUNDAMENTAL OCCUPATIONAL

ELD 104 - Electrical System Maps, Schematics, and Symbols

Course Outline

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
SYSTEM MAP READING		**4**	**2**
Symbols	Identify symbols used in system maps to represent substation components.		
	Identify symbols used in system maps to represent overhead distribution components.		
	Identify symbols used in system maps to represent underground residential distribution components.		
Keys and legends	Interpret contents of distribution system map legends.		
ELECTRICAL SYMBOLS AND SCHEMATIC DIAGRAMS		**8**	**3**
Symbols and diagrams	Identify electrical concepts, terms, and symbols used in schematic diagrams.		
COMPONENT IDENTIFICATION		**8**	**5**
Transmission systems	Identify transmission lines and stations by voltages, structures, and purpose.		
	Identify distribution substations by voltages and purpose.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Identify components of a substation using a substation system map.		
Distribution systems	Describe a single-phase and three-phase loop feed commercial distribution system using a system map.		
	Identify the characteristics of a loop feed system and the role of a normal-open point.		
	Describe single-phase and three-phase radial feed residential systems using system maps.		
	Compare and contrast loop and radial feed systems in terms of applications and the effects on customers during service.		
	Identify three-phase distribution systems by visual inspection.		
	Identify single-phase distribution systems by visual inspection.		
	Identify secondary lines and structures.		
	Identify underground residential distribution (URD) components and structures using URD system maps.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
Transformers	Identify types of transformers. Identify and interpret information on transformer name plates. Identify metering components (self-contained, single-phase, poly-phase, and transformer-rated types). Identify "arrow" systems for paralleling transformers.		

FUNDAMENTAL OCCUPATIONAL

ELD 104 - Electrical System Maps, Schematics, and Symbols

Resources

Edison Electrical Institute. (1970). *Glossary of electrical utility terms*. Washington, DC: Author.

Gebert, K. L. (1986). *National electrical code blueprint reading* (10th ed.). Homewood, IL: American Technical.

Kubla, T. S. (1986). *Electricity 2: Devices, circuits, and materials*. Albany, NY: Delmar.

Kurtz, E. B., & Shoemaker, T. M. (1986). *The lineman's and cableman's handbook* (7th ed.). New York: McGraw-Hill.

Westinghouse Electric Corporation. (1975). *Workbook for the Westinghouse sales training course: Introduction to basic electricity and power systems* (MA236B). Pittsburgh, PA: Author.

FUNDAMENTAL OCCUPATIONAL

ELD 105 - Wiring for Electrical Distribution

Course Overview

Course Description

Introduces electrical distribution wiring practices and procedures. Topics include: National Electrical Code, electrical connections, and wiring safety.

Competency Areas

National Electrical Code
Electrical Connections
Wiring Safety

Prerequisites/Corequisites

ELD 101, ELT 102

Credit Hours

3

Contact Hours Per Week

Class - 3

P.Lab - 2

Document Number:
03-05-02

FUNDAMENTAL OCCUPATIONAL

ELD 105 - Wiring for Electrical Distribution

Course Outline

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
NATIONAL ELECTRICAL CODE		**5**	**0**
Uses and installation	Describe the provisions of Article 339 of the National Electrical Code.		
ELECTRICAL CONNECTIONS		**15**	**15**
Weatherhead and meter base connections	Make up both straight and H-type weatherhead and meter base connections.		
Cable splicing	Splice primary and secondary cable using a quick sleeve.		
	Splice primary and secondary cable using a hydraulic tension sleeve.		
Jumpers	Connect jumper (double deadend).		
Groundwire	Make groundwire connections using split connectors.		
WIRING SAFETY		**10**	**5**
General	Identify situations requiring a dead line clearance.		
	Insure that an adequate air gap exists.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Select appropriate personal protective equipment.		
Service connections	Check resistance and voltage on service connection.		
	Identify situations where lineworkers should not make meter connections.		

FUNDAMENTAL OCCUPATIONAL

ELD 105 - Wiring for Electrical Distribution

Resources

Edison Electrical Institute. (1970). *Glossary of electrical utility terms*. Washington, DC: Author.

Gebert, K. L. (1986). *National electrical code blueprint reading* (10th ed.). Homewood, IL: American Technical.

Kubla, T. S. (1986). *Electricity 2: Devices, circuits, and materials*. Albany, NY: Delmar.

Kurtz, E. B., & Shoemaker, T. M. (1986). *The lineman's and cableman's handbook* (7th ed.). New York: McGraw-Hill.

Westinghouse Electric Corporation. (1975). *Workbook for the Westinghouse sales training course: Introduction to basic electricity and power systems* (MA236B). Pittsburgh, PA: Author.

FUNDAMENTAL OCCUPATIONAL

ELT 102 - Electricity Principles

Course Overview

Course Description

Introduces electrical theory and principles used in residential, commercial, and industrial wiring applications. Emphasis is placed on electron theory, DC and AC circuits, Ohm's law, test equipment, transformers, and electrical power systems. Topics include: electricity production, electrical formulas, test equipment, transformer fundamentals, and fundamentals of AC and DC circuits.

Competency Areas

Electricity Production
Electrical Formulas
Test Equipment
Transformer Fundamentals
Fundamentals of AC and DC Circuits

Prerequisite/Corequisite

MAT 101

Credit Hours

9

Contact Hours Per Week

Class - 8

D.Lab - 1

P.Lab - 5

FUNDAMENTAL OCCUPATIONAL

ELT 102 - Electricity Principles

Course Outline

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
ELECTRICITY PRODUCTION		**10**	**5**
Electrical structure of matter	Describe protons, neutrons, and electrons.		
	Describe ions.		
	Describe the role of free and at-rest electrons in producing electricity.		
Static electricity	Create static electricity using common sources (e.g., plastic, glass, silk, and nylon).		
	Describe opposite and like charges.		
Conductors and insulators	Define the terms conductance and insulator.		
	Demonstrate conductance and insulation of various materials using static electricity.		
Capacitance	Describe a capacitor or condenser.		
	Calculate capacitance given charge and potential difference.		
	Define dielectric constant.		
	Look up the dielectric strength of common materials.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Read and interpret capacitor values.		
Electrical current and resistance	Define electrical potential.		
	Discuss the magnetic field created by a current flowing through a wire.		
	Read and interpret color codes to identify resistors.		
ELECTRICAL FORMULAS		**10**	**0**
Resistance formulas	Calculate the value of total resistance for resistors in series.		
	Calculate the value of total resistance for resistors in parallel.		
Capacitance formulas	Calculate the value of total capacitance for capacitors in series.		
	Calculate the value of total capacitance for capacitors in parallel.		
Ohm's law	Use Ohm's law to calculate voltage and current in simple DC circuits.		
TEST EQUIPMENT		**10**	**10**
VOM	Demonstrate proper use and care of the VOM.		
	Measure voltage and current using the VOM.		
Clamp-on ammeter	Demonstrate proper use and care of the clamp-on ammeter.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Measure current using the clamp-on ammeter.		
Megohmeter	Demonstrate proper use and care of the megohmeter.		
	Measure resistance using the megohmeter.		
Tachometer	Demonstrate proper use and care of the tachometer.		
	Measure motor speed using the tachometer.		
Continuity tester	Demonstrate the proper use and care of the continuity tester.		
	Measure continuity with a continuity tester.		
TRANSFORMER FUNDAMENTALS		**10**	**5**
Transformer types	Describe isolation, power, and high-voltage transformers.		
Transformer theory	Describe the construction of step-up and step-down transformers.		
	Explain the color-coding used in transformer inputs and outputs.		
	Identify primary and secondary transformer windings.		
	Differentiate between an open and closed core transformer.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Describe the construction of an iron core transformer and explain the function of each component.		
	Describe hysteresis loss.		
	Use Lenz's law to describe the magnetic fields in a transformer.		
Transformer calculations	Given voltage required, voltage input, and primary winding, compute the secondary winding.		
	Given turns ratio and input voltage, calculate output voltage of a transformer.		
FUNDAMENTALS OF AC AND DC CIRCUITS		**40**	**40**
Introduction to DC circuits	Describe sources of DC power.		
	Define the following terms: electromotive force, potential, potential difference, and current flow.		
Units of measurement and formulas	Define the following units of measurement: coulomb, ampere, and milliampere.		
	Make power computations using (P=IxE).		
Circuit types	Identify series DC circuits.		
	Identify parallel DC circuits.		
DC circuit measurements	Perform DC calculations and measurements on series circuits.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Perform DC calculations and measurements on parallel circuits.		
Introduction to AC circuits	Describe induced current using Lenz's law.		
	Describe the components of a simple generator.		
	Graph the sinusoidal waveform of an A-C output.		
	Define cycle, frequency, hertz, and amplitude.		
	Describe the difference between resistance and impedance.		
Factors affecting AC current	Describe how resistance affects AC phase output.		
	Describe how capacitance affects AC output.		
	Describe how inductance affects AC output.		
AC circuit measurements and computations	Compute the R-L time constant for A-C circuits.		
	Compute the R-C time constant for A-C circuits.		
	Measure voltage and current in series and parallel A-C circuits.		
	Determine the total impedance and admittance of A-C series and parallel circuits.		

FUNDAMENTAL OCCUPATIONAL

ELT 102 - Electricity Principles

Resources

Adams, J. (1973). *Electrical principles and practices.* New York: McGraw-Hill.

Alerich, W. N. (1981). *Electricity 3.* Albany, NY: Delmar.

Alerich, W. N. (1981). *Electricity 4.* Albany, NY: Delmar.

Baker & Crow. (1971). *Electricity fundamentals.* Indianapolis: Howard W. Sams.

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Croft, T., Carr, C. C., & Watt, J. H. (1970). *American electricians' handbook.* New York: McGraw-Hill.

DeGuilmo, J. M. (1982). *Electrical/electronics principles and applications.* Albany, NY: Delmar.

Dezettel, L. M. (1972). *ABC's of electrical soldering.* Indianapolis: Howard W. Sams.

Duff, J. (1961). *AC fundamentals.* New York: Delmar.

Dunlap, Sefert, & Austin. (1972). *Transformers.* Chicago: American Technical.

Faber, R. B. (1982). *Applied electricity and electronics for technology.* New York: Wiley.

Fuchs, D. J., & Gerstang, S. (1972). *Electrical motor controls.* Indianapolis: Howard W. Sams.

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SPECIFIC OCCUPATIONAL

ELD 106 - Powerline Construction, Maintenance, and Repair

Course Overview

Course Description

Introduces powerline construction, maintenance, and repair techniques. Topics include: rope handling and rigging for powerline construction and repair, pole framing and installation, line conductors and insulators, pole and line hardware installation, protective grounding and equipment grounding, energizing and de-energizing circuits and other equipment, introduction to bucket and digger/derrick truck operations and maintenance, and powerline construction and maintenance safety.

Competency Areas

Rope Handling and Rigging
Pole Framing and Installation
Line Conductors and Insulators
Hardware Installation
Protective Grounding and Equipment Grounding
Circuit Energizing and De-Energizing
Bucket and Digger/Derrick Truck Operations and Maintenance
Powerline Construction and Maintenance Safety

Prerequisites

ELD 102, ELD 103, ELD 104, ELD 105

Credit Hours

7

Contact Hours Per Week

Class - 5

D.Lab - 1

P.Lab - 8

SPECIFIC OCCUPATIONAL

ELD 106 - Powerline Construction, Maintenance, and Repair

Course Outline

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
ROPE HANDLING AND RIGGING		**5**	**10**
Manual component installation	Rig block and tackle to change pole-mounted transformers.		
	Rig hand lines.		
	Rig collar ropes to hang blocks.		
	Rig collar ropes to sag wire.		
POLE FRAMING AND INSTALLATION		**8**	**15**
Pole framing	Frame a straight line pole with pin type insulators.		
	Frame an angle pole with suspension insulators.		
	Frame a dead-end pole.		
Pole installation	Prepare line truck for pole setting.		
	Position line truck for pole setting.		
	Determine depth of pole hole based on pole length.		
	Dig pole hole manually.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Dig pole hole using line truck auger.		
	Tamp pole hole before pole installation.		
	Set pole using line truck.		
	Backfill pole hole.		
LINE CONDUCTORS AND INSULATORS		**5**	**10**
Conductor installation	Layout line conductors.		
	Rig rollers on poles.		
	Make-up on beginning end of pull.		
	Ground conductor.		
	Lay conductors on rollers.		
	Mount conductors on insulators using preformed and hand formed ties.		
	Sag conductor.		
Insulator installation	Select appropriate insulators.		
	Install suspension and pin-type insulators.		
HARDWARE INSTALLATION		**10**	**20**
Pole-mounted hardware	Install transformers.		
	Install lightning arrestors.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Install oil circuit breakers.		
	Install oil circuit reclosers.		
	Install switches and fuses.		
	Install ground wires.		
	Install voltage regulators.		
PROTECTIVE GROUNDING AND EQUIPMENT GROUNDING		5	5
Protective grounding	Install single point personal protective ground.		
	Install double point personal protective ground.		
Equipment grounding	Install equipment ground on line truck.		
	Install equipment ground on bucket truck.		
CIRCUIT ENERGIZING AND DE-ENERGIZING		5	5
Circuit de-energization	Open switches using load buster tool.		
	Open circuits using oil circuit reclosers.		
Circuit energization	Close switches using hot sticks.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
BUCKET AND DIGGER/DERRICK TRUCK OPERATIONS AND MAINTENANCE		**6**	**15**
Pretrip inspection	Perform pretrip inspection of bucket and digger/derrick trucks.		
Vehicle operations	Identify procedures for placement and leveling of bucket and digger/derrick trucks.		
	Identify bucket truck controls.		
	Operate bucket truck using bucket controls.		
	Operate bucket truck using ground controls.		
	Install protective cover-up using bucket truck.		
	Install three-phase single and double cross arms using bucket truck.		
	Install single pole-mounted transformers using bucket truck.		
	Identify digger/derrick truck controls.		
	Operate digger/derrick truck controls.		
	Dig hole using digger.		
	Set pole with truck.		
	Align pole using truck.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Perform trailer backing techniques.		
POWERLINE CONSTRUCTION AND MAINTENANCE SAFETY		**6**	**10**
Personal protection	Inspect climbing equipment before use.		
	Inspect poles for unsafe conditions.		
	Inspect personal protective equipment.		
	Inspect ropes, blocks, and tackle before use.		
	Demonstrate safe lifting techniques.		
	Determine the need for a dead line clearance.		
	Identify situations requiring the use of personal protective equipment.		
	Describe the concept of personal positioning.		
Equipment protection	Identify situations requiring the use of equipment ground.		
	Install equipment ground.		

SPECIFIC OCCUPATIONAL

ELD 106 - Powerline Construction, Maintenance, and Repair

Resources

American Public Power Association. (1988). *Safety manual for an electric utility* (8th ed.). Washington, DC: Author.

Center for Occupational Research & Development. (1981). *Electrical power transmission and distribution safety.* Waco, TX: Author.

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Kurtz, E. B., & Shoemaker, T. M. (1986). *The lineman's and cableman's handbook* (7th ed.). New York: McGraw-Hill.

SPECIFIC OCCUPATIONAL

ELD 107 - Transformers

Course Overview

Course Description

Provides instruction on the theory, operation, installation, and banking of specific types of transformers. Emphasis will be placed on National Electrical Code requirements related to the installation of transformers. Topics include: transformer theory; types of transformers, such as dual voltage transformers, autotransformers, buck-boost transformers, and single- and three-phase step-down transformers; National Electrical Safety Code requirements; three-phase power systems; transformer installation, connections, and banking; and transformer safety and disposal of hazardous materials.

Competency Areas

Transformer Theory
Types of Transformers
National Electrical Safety Code Requirements
Three-Phase Power Systems
Transformer Installation, Connections, and Banking
Transformer Safety and Disposal of Hazardous Materials

Prerequisites

ELD 102, ELD 105, ELT 102

Credit Hours

6

Contact Hours Per Week

Class - 4

D.Lab - 2

P.Lab - 4

SPECIFIC OCCUPATIONAL

ELD 107 - Transformers

Course Outline

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
TRANSFORMER THEORY		**11**	**7**
Delta/wye systems	Describe the characteristics of delta systems. Describe the characteristics of wye systems.		
Terms and concepts	Identify terms, concepts, and their significance as they relate to transformer service.		
Applied computations	Use formulas to compute output voltages given input voltage, system configuration, and transformer information.		
TYPES OF TRANSFORMERS		**4**	**7**
Functions	Identify the fundamental functions of transformers (both current and potential transformers).		
Types, construction, and operating principles	Describe the types, construction, and operating principles of current transformers. Identify types of overhead and underground transformers.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
Data plates	Interpret information on transformer name plates.		
NATIONAL ELECTRICAL SAFETY CODE REQUIREMENTS		**4**	**0**
N.E.S.C. provisions	Identify transformer construction specifications as outlined in the National Electrical Safety Code.		
	Identify the National Electrical Safety Code provisions for transformer installation.		
THREE-PHASE POWER SYSTEMS		**5**	**0**
Transformers in electrical systems	Identify three-phase distribution.		
	Describe the role of transformers in single-phase and three-phase loop feed systems.		
	Describe the role of transformers in single-phase and three-phase radial feed systems.		
Circuit switches	Identify electronic three-phase breakers.		
	Identify types of oil circuit breakers (OCB).		
	Identify types of oil circuit reclosers.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
TRANSFORMER INSTALLATION, CONNECTIONS, AND BANKING		**13**	**36**
Transformer installation	Use a continuity tester to check continuity.		
	Use an ohmmeter to measure resistance.		
	Use a kick-tester to test transformer function.		
	Use a voltmeter to measure secondary voltage.		
	Install and connect pole-mounted single-phase transformers 120/240.		
	Re-fuse transformers using a switch stick.		
Troubleshooting	Troubleshoot secondary for high voltage.		
	Troubleshoot secondary for low voltage.		
	Troubleshoot secondary for blinking lights.		
Installation	Identify loop and radial feed system line grounding techniques (equalization of electrical potential, both single point and working between grounds).		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Identify equipment grounding techniques.		
	Identify protective cover-up equipment (i.e., rubber blanket, rubber [flexible] line hose, and rubber [rigid] line guards).		
	Identify the need for a dead line clearance.		
Connection and banking	Connect a pole-mounted wye-delta bank for three-phase, four-wire 120/240 volt service.		
	Connect a wye-delta bank for three-phase, three-wire 240 volt service.		
	Connect a wye-wye bank for three-phase, four-wire 120/208 volt service.		
	Connect a wye-wye bank for three-phase, four-wire 277/480 volt service.		
	Connect an open-wye, open-delta bank for three-phase, four-wire 120/240 volt service.		
	Connect an open-wye, open-delta bank for three-phase, three-wire 240 volt service.		
	Connect an open-delta, open-delta bank for three-phase, four-wire 120/240 volt service.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Connect a delta, delta bank for three-phase, four-wire 120/240 volt service.		
	Identify "arrow" systems for paralleling transformers.		
	Use a rotation meter to check rotation on three-phase service.		
	Change rotation on a three-phase service.		
	Tag pad-mounted transformer connections.		
	Identify procedures for bypassing current transformers.		
	Install and connect single- and three-phase pad-mounted transformers.		
TRANSFORMER SAFETY AND DISPOSAL OF HAZARDOUS MATERIALS		**3**	**10**
Hazards	Identify the hazards associated with exposure to askerel (PCBs).		
Cleanup	Identify procedures for cleanup of askerel spills.		
Exposure	Identify the provisions of the Hazardous Duty Standards Act (Right-to-Know legislation and the M.S.D.S.).		

SPECIFIC OCCUPATIONAL

ELD 107 - Transformers

Resources

American Public Power Association. (1988). *Safety manual for an electric utility* (8th ed.). Washington, DC: Author.

Billing, R. A. (1983). *Distribution transformer theory for line people*. Champaigne, IL: Author.

General Electric Co. (1987). *Distribution transformers manual* (GET-2485Q). Hickory, NC: Author.

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SPECIFIC OCCUPATIONAL

ELD 108 - Underground Residential and Commercial Distribution

Course Overview

Course Description

Introduces concepts and practices relating to underground distribution (URD) for residential, commercial, and light industrial consumers of electricity. Topics include: underground distribution materials design; underground distribution systems layout; URD pothead and transformer terminations; tools and equipment; digging, trenching, and shoring operations; underground systems conductor, transformer, switching cubicle, and meter installation; URD systems troubleshooting and repair; manhole and switching cubicle operations; and URD safety.

Competency Areas

Underground Distribution Materials Design
URD Systems Layout
Underground Terminations
Tools and Equipment
Digging, Trenching, and Shoring Operations
Installation Techniques for Underground Systems
Troubleshooting and Repair of URD Systems
Manhole and Switching Cubicle Operations
URD Safety

Prerequisites/Corequisites

ELD 106, ELD 107

Credit Hours

5

Contact Hours Per Week

Class - 4

D.Lab - 1

P.Lab - 4

SPECIFIC OCCUPATIONAL

ELD 108 - Underground Residential and Commercial Distribution

Course Outline

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
UNDERGROUND DISTRIBUTION MATERIALS DESIGN		**8**	**7**
URD materials	Identify URD materials and structures.		
	Identify the construction specifications for URD materials as outlined in the National Electrical Safety Code.		
URD components	Identify types of URD grounding devices.		
	Identify types of underground terminators.		
	Identify types of URD elbows.		
	Identify types of URD fuses.		
	Identify URD switching cabinets and cubicles.		
	Identify URD transformer pads.		
	Identify URD electronic three-phase breakers.		
	Identify loadbreak and nonloadbreak type bushings, bushing covers, elbows, oil switches, bayonet fuses, and primary and secondary switches.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Identify types of lightning arrestors.		
URD SYSTEMS LAYOUT		**8**	**10**
URD installation techniques	Identify and use underground distribution cable and fault locating equipment.		
	Describe single-phase and three-phase loop feed URD systems.		
	Identify the characteristics of a loop feed system and the role of a normal-open point.		
	Describe single-phase and three-phase radial feed URD systems.		
	Compare and contrast loop and radial feed systems in terms of applications and the effects on customers during service.		
System maps	Identify symbols used in system maps to represent substation components.		
	Identify symbols used in system maps to represent underground residential distribution components.		
	Identify for operation of switching cabinets and cubicles.		
	Tag (label) cables using accepted conventions.		
Splices	Make splices on underground secondary cables.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Make splices on underground primary cables.		
	Make electrical connections in aluminum and copper cables.		
	Tag pad-mounted transformer connections.		
UNDERGROUND TERMINATIONS		**4**	**10**
Preservice/installation	Install protective cover-up equipment (i.e., rubber blanket, rubber [flexible] line hose, rubber [rigid] line guards).		
	Identify the importance of proper shoring during trenching and other excavation activities.		
	Identify types of grounding devices.		
	Identify types of sleeves and connectors.		
	Identify types of underground terminators.		
TOOLS AND EQUIPMENT		**4**	**3**
Tool/equipment use	Select correct tools and equipment.		
	Identify line tools.		
	Identify continuity testers.		
	Use a voltmeter to measure secondary voltage.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Use an ammeter to measure secondary amperage.		
	Use an ohmmeter to measure resistance.		
	Use a cable locator to locate primary and secondary URD cables.		
	Use underground distribution fault locating equipment.		
DIGGING, TRENCHING, AND SHORING OPERATIONS		**4**	**2**
Preservice	Identify the need for a dead line clearance.		
	Identify safe positioning and procedures for setup of vehicles and other equipment.		
Digging/trenching	Dig trenches using trenching equipment.		
Shoring	Shore trenches and excavations in accordance with OSHA regulations.		
INSTALLATION TECHNIQUES FOR UNDERGROUND SYSTEMS		**2**	**6**
Conductor installation	Lay URD conductor in trench.		
	Make splices in URD cable.		
	Make terminal connections in URD cable.		
	Tag (label) cable terminations.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
Transformer installation	Tag pad mounted transformer connections.		
	Install pad mounted transformer.		
	Connect pad mounted transformer connections.		
Demand meter installation	Install demand meters.		
Switching vault and cubicle installation	Install switching vaults.		
	Install switching cubicles.		
TROUBLESHOOTING AND REPAIR OF URD SYSTEMS		**4**	**3**
System characteristics	Identify the characteristics of a loop feed system and the role of a normal-open point.		
	Compare and contrast loop and radial feed systems in terms of applications and the effects on customers during service.		
Troubleshooting	Troubleshoot secondary line for low voltage.		
	Troubleshoot secondary line for high voltage.		
	Troubleshoot secondary line for blinking lights.		
	Troubleshoot potential on water pipes or appliances.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Troubleshoot frequent circuit breaker tripping.		
	Troubleshoot electrical equipment.		
	Troubleshoot primary line for low line voltage.		
	Troubleshoot primary line for high line voltage.		
	Troubleshoot primary line for blinking lights.		
	Troubleshoot primary line for extreme voltage swing.		
	Troubleshoot primary line for radio and television interference.		
	Troubleshoot primary line for line outage.		
	Use cable locator to locate primary and secondary URD cables.		
	Troubleshoot faults in primary URD cable.		
	Troubleshoot faults in secondary URD cable.		
	Troubleshoot area, security, and street lighting systems.		
Customer relations	Describe procedures for proper entry of private property with regard to damage of private property.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Remove debris upon job completion.		
	Identify the reasons for notification of the Utility Notification Center.		
MANHOLE AND SWITCHING CUBICLE OPERATIONS		**2**	**4**
Voltage regulators	Connect source, load, and ground bushings of voltage regulators.		
	Operate voltage regulator controls.		
Manhole operations	Test manhole for the presence of toxic, flammable, and nonlife supporting gases using electronic devices.		
	Demonstrate manhole rescue techniques.		
URD SAFETY		**4**	**5**
Vehicle and equipment setup	Identify safe positioning and procedures for setup of vehicles and other equipment.		
Grounding techniques	Identify line grounding techniques (equalization of electrical potential, both single point and working between grounds).		
	Identify equipment grounding techniques.		
	Identify techniques for manhole rescue.		
	Field test rubber gloves.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Identify protective cover-up equipment (i.e., rubber blanket, rubber [flexible] line hose, rubber [rigid] line guards).		
	Identify the basic principles of safely working on energized circuits (i.e., clearance, positive control, and care of tools).		
	Wear personal protective equipment (i.e., hard hat, eye protection, rubber shoes, and gloves) where appropriate.		
	Maintain personal protective equipment.		
	Ground equipment where appropriate.		
	Use line grounding techniques (equalization of electrical potential, both single point and working between grounds).		
	Use proper shoring during trenching and other excavation activities.		
	Use equipment and line grounding devices.		
	Use hand signals.		

SPECIFIC OCCUPATIONAL

ELD 108 - Underground Residential and Commercial Distribution

Resources

A. B. Chance Co. (1974). *Hot sticks: A manual on high voltage line maintenance*. Centralia, MO: Author.

American Public Power Association. (1988). *Safety manual for an electric utility* (8th ed.). Washington, DC: Author.

Center for Occupational Research & Development. (1981). *Electrical power transmission & distribution safety*. Waco, TX: Author.

Edison Electrical Institute. (1970). *Glossary of electrical utility terms*. Washington, DC: Author.

General Electric Co. (1987). *Distribution transformers manual* (GET-2485Q). Hickory, NC: Author.

The Institute of Electrical and Electronics Engineers, Inc. (1988). *National electrical safety code, 1988 edition*. New York: Author.

Kurtz, E. B., & Shoemaker, T. M. (1986). *The lineman's and cableman's handbook* (7th ed.). New York: McGraw-Hill.

SPECIFIC OCCUPATIONAL

ELD 109 - Advanced Electrical Distribution

Course Overview

Course Description

Presents the principles of and methods for safe live-line work, right-of-way maintenance, and advanced equipment operations. Topics include: line phasing and phase rotation; replacement of components such as insulators, capacitors, transformers, and voltage regulators; identification, care, and use of live-line tools; right-of-way maintenance, such as limb and tree removal techniques; hazardous materials cleanup; and live-line safety.

Competency Areas

Line Phasing and Phase Rotation
Component Replacement
Identification, Care, and Use of Live-Line Tools
Right-of-Way Maintenance
Hazardous Materials Cleanup
Live-Line Safety

Prerequisites/Corequisites

ELD 106, ELD 107

Credit Hours

5

Contact Hours Per Week

Class - 3

D.Lab - 2

P.Lab - 5

SPECIFIC OCCUPATIONAL

ELD 109 - Advanced Electrical Distribution

Course Outline

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
LINE PHASING AND PHASE ROTATION		**5**	**6**
Phasing	Phase a line using phasing sticks.		
Rotation	Use a rotation meter to check rotation on three-phase service.		
	Change rotation on three-phase service.		
COMPONENT REPLACEMENT		**13**	**23**
Street lighting	Identify components of various types of lighting systems (e.g., area, street, and security lighting).		
Transformers	Re-fuse transformers using a switch stick.		
Insulators	Identify procedures to change insulators on a hot line conductor using hot line tools.		
	Change insulators using rubber gloves.		
Voltage regulators	Demonstrate the procedures to connect the source, load, and ground bushings of voltage regulators.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Operate voltage regulator controls.		
	Perform truck inspection.		
Use of bucket and digger/ derrick trucks	Identify bucket truck controls.		
	Identify digger/derrick controls.		
	Operate bucket truck using ground controls.		
	Operate bucket truck using bucket controls.		
	Hang a single transformer on pole from bucket truck.		
	Install protective cover-up on three-phase lines.		
	Hang bells (insulators) from bucket truck.		
	Change insulator using rubber gloves from bucket truck.		
	Install equipment ground.		
	Set pole in energized line.		
	Identify situations where equipment ground must be installed.		
IDENTIFICATION, CARE, AND USE OF LIVE-LINE TOOLS		**5**	**11**
Identification	Identify line tools.		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Identify hot line tools.		
Care	Describe the care of hand, line, and hot line tools.		
Use	Demonstrate the use and care of hot sticks.		
RIGHT-OF-WAY MAINTENANCE		**1**	**11**
Limb removal, trimming, and felling trees	Demonstrate limb removal techniques.		
	Demonstrate limb removal techniques over energized conductors.		
	Demonstrate techniques for felling a tree.		
	Operate power saws and trimmers.		
HAZARDOUS MATERIALS CLEANUP		**1**	**6**
Identification	Identify hazardous materials used in the electrical distribution industry.		
Cleanup	Identify cleanup techniques for hazardous materials.		
Health hazards	Describe the provisions of the Hazardous Duty Standards Act (Right-to-Know legislation and the M.S.D.S.).		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
LIVE-LINE SAFETY		**5**	**13**
Personal protective equipment	Identify personal protective equipment (i.e., hard hat, eye protection, rubber shoes, and gloves).		
	Identify procedures for inspecting tools and personal protective equipment.		
	Identify procedures for maintaining personal protective equipment.		
	Identify methods for field testing rubber gloves.		
Shock prevention	Identify the cardinal principles of powerline safety (i.e., clearance, cover-up, grounding, positive control, personal positioning, and equipment positioning).		
	Identify equipment grounding techniques.		
	Identify the need for a dead line clearance.		
	Identify situations where equipment ground must be installed.		
	Identify line grounding techniques (equalization of electrical potential, both single point and working between grounds).		

Recommended Outline	After completing this section, the student will:	Hours Class	Hours Lab
	Install line guard from poles.		
	Install insulated blankets from pole.		
	Install insulator cover (hood).		
	Install insulated rubber line hose from pole.		
Rigging safety	Identify methods of inspecting ropes and cables.		
	Calculate the safe working load of various ropes and cables.		
	Identify the effects of knots on the strength of rope.		
Climbing safety	Inspect poles for unsafe conditions before climbing.		
	Inspect climbing equipment.		
Worksite setup	Identify safe positioning and procedures for setup of vehicles and other equipment.		

SPECIFIC OCCUPATIONAL

ELD 109 - Advanced Electrical Distribution

Resources

A. B. Chance Co. (1974). *Hot sticks: A manual on high voltage line maintenance*. Centralia, MO: Author.

American Public Power Association. (1988). *Safety manual for an electric utility* (8th ed.). Washington, DC: Author.

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APPENDIX A

EQUIPMENT LIST

APPENDIX A

Electrical Distribution

Equipment List

Ammeter, clamp-on type
Anchor, 5/8", 12 ea.
Anchor, guy, 5/8" X 5', rod and cone type, 10 ea.
Arrester, lightning, 15kv, 6 ea.
Auger
Axe, double-bitted
Axe, brush (bush hook)
Bit, drill (or auger), 11/16"
Bit, drill (or auger), 13/16"
Blanket, rubber, 36" X 36", 4 ea.
Blanket, rubber, split type, 24" X 24", 2 ea.
Block, 2 sheave, w/hook and snap, w/thimble, 2 ea.
Block, 3 sheave, w/hook and snap, w/thimble, 1 ea.
Bolt, machine, 1/2" X 10", 3 ea.
Bolt, eye, 5/8" X 12", 12 ea.
Bolt, D.A., 5/8" X 8", 9 ea.
Bolt, machine, 1/2" X 6", w/nuts, 10 ea.
Bolt, carriage, 3/8" X 6", 2 ea.
Bolts, carriage, 3/8" by 5", 40 ea.
Bolts, machine, 3/4" X 14", w/nuts, 4 ea.
Bolts, lag, driving, 3/8" X 5", 20 ea.
Bolts, through, No. 12, 5/8" (with nuts), 20 ea.
Bolts, through, No. 10, 5/8" (with nuts), 10 ea.
Braces, crossarm, 28", 20 ea.
Cable, equipment ground, 1/0, 12 ft., w/grounding clamps, 6 ea.
Cable, ground, personal protective, 50 ft., w/grounding clamps, 2 ea.
Cable fault locator, URD
Cable locator, URD
Capacitor bank assembly, 1 ea.
Caps, insulating, for elbows, 4 ea.
Clamp, hot-stick
Clamps, deadend, No. 2 ACSR, 12 ea.
Conductor, wire, No. 2, ACSR, 5000 ft. length, 1 ea.
Conductor, cable, URD, 1/0, aluminum, jacketed, w/concentric neutral, 450 ft., 1 ea.
Connector, elbow, load-break, for 1/0 conductor, 8 ea.

Continuity tester
Cover, riser (for cable), PVC, 4" X 60 ft., 1 ea.
Crossarms, 8 ft., 10 ea.
Cutter, wire and conductor, 2 ea.
Cutter, bolt, No. 2, 2 ea.
Cutter, cable, No. 1, 1 ea.
Deadend assembly, neutral, 3 ea.
Deadend assembly, primary, 6 ea.
Eyebolt, 5/8", 12 ea.
Eye nut, oval, 5/8", 12 ea.
Eye nut, 5/8", 1 ea.
Fid, wooden, 6", 3 ea.
Fid, aluminum, hollow, 6" length, 1/2" diameter, 3 ea.
Gloves, Class 2, insulating, rubber, long cuff, w/leather protectors and canvas bag, 4 pair
Grips, wire, aluminum, 10 ea.
Grips, conductor, steel type, 4 ea.
Grips, conductor, ACSR type, 4 ea.
Guy attachments, both through bolt-type and goat-head type, 15 ea.
Hoist, 4 ea., (for pulling guy and conductor wire) any type
Hose, line, rubber, 12 ft. length, 10 ea.
Hot sticks, assorted types, w/assorted clamps
Insulator, suspension, 6", 18 ea.
Insulator, pin-type, 15kv, 10 ea.
Clevis, secondary, 10 ea.
Module, feed-through (URD), 2 ea.
Motor, power drill, 1/2" drive
Overshoes, insulating, rubber
Pin, pole-top, 5 ea.
Pin, crossarm, 10 ea.
Pole, 40 ft., class 5, 2 ea.
Pole, 35 ft., class 5, 12 ea.
Pole, 30 ft., class 5, 6 ea.
Recloser, 3-phase, w/ conduit, control cabinet, and other hardware, 1 ea.
Regulator, voltage, step-type, w/remote control kit and mounting hardware, 3 ea.
Rod, ground, 5/8" X 8', steel, galvanized, 20 ea.
Rods, armor, No. 2, aluminum, 15 ea.
Rope, roller, polypropylene, 300 foot length, 3/8 inch diameter
Rope, nylon, double-braided, 4 foot length, 3/8 inch diameter, 1 ea. per student (for knot tying and splicing).
Rope, nylon, 3-in-1 twist, 6 foot length, 3/8 inch diameter, 1 ea. per student (for knot tying and splicing).
Saw, tree

Saw, pruning
Sheave, hand line, w/hook and snap, 5 ea.
Staples, ground wire, 1000 ea.
Switch, airbreak, 3-pole unit w/operating mechanism and insulated spacers, 1 ea.
Switch, disconnect, underslung type, 3 ea.
Switch, voltage regulator, by-pass, 3 ea.
Terminator, elbow, pothead and sleeve, for primary UD cable, 1/0, 6 ea.
Thimble eye, 5/8", 4 ea.
Tie, preformed, wire, straight, No. 2 ACSR, 15 ea.
Tie, preformed, wire, angle side, No. 2 ACSR, 15 ea.
Tie, wire, No. 6, aluminum, 100 ft.
Transformer, single-phase, pad mounted w/pads, 2 ea.
Transformer pole mounted, 10 KVA, 3 ea.
Triplex (aluminum), No. 2, 30 ft. length, 5 ea.
Truck, digger/derrick
Truck, bucket
Voltmeter, 440v, 2 ea.
Washer, guy, 20 ea.
Washer, round, 1" X 9/16" hole, 25 ea.
Washer, square, 1" X 9/16" hole, 25 ea.
Washer, round, 1 3/8", 9/16" hole, 8 ea.
Washers, square, 2", 13/16" hole, 100 ea.
Wire, ground, No. 6 S.D. copper, 400 ft., 1 ea.
Wire, guy, 7/16" diameter, 400 ft., 1 ea.

Student's Standard Tool Kit Contents

Belt, body, lineman's
Boots, work, high-top
Climbers, pole
Glasses, safety
Gloves, leather palm, long cuff
Goggles, safety, full-cover
Hammer, lineman's, 24 ounce
Hard-hat
Knife, skinning
Pliers, side cutting, nine inch
Pouch, tool, canvas
Rope, nylon, braided, 5/8 inch, 40 foot (hand line)
Rule, folding, six foot, non-conductive
Screwdriver, flat-tip, 12 inch
Shirt, work, long sleeve
Strap, safety
Wrench, adjustable, 12 inch
Wrench, adjustable, 10 inch